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SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

New York City: Grand Central Terminal.

Lancaster, Pa. Garrison, N. Y.

Annual Subscription, $6.00. Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

THE FORGOTTEN PHYSICIAN[1]

I APPRECIATE to the full the honor which has been given me to be present to-day on this platform. I have elected to say something on a subject which is very prominent in my thoughts and very pertinent to the modern trend of medical education and development, and shall speak of the forgotten physician.

In the fall of 1904, at its one hundred and fiftieth anniversary, Columbia University gave the honorary degree of LL.D. to three graduates of the College of Physicians and Surgeons. These three men, who in their day meant much to the profession of New York, were Edward G. Janeway, Francis Delafield and William M. Polk. At the time these men graduated there were three outstanding proprietary medical schools which to-day have developed into three university schools of the highest rank. Janeway, Delafield and Polk became connected in high office, each with a different one of these three schools, and each came to stand for the ideals of the profession and the aspirations of the schools. It were indeed strange if I dared to refer to such men as forgotten physicians. All three at one time were connected with Bellevue Hospital, in which institution you have received a large part of your own education. It can not but be true that you found in Bellevue a tradition emphasizing the work and influence of each one of these leaders during the days of your grandfathers. Delafield was a trained pathologist, who brought an intimate knowledge of microscopic anatomy to his studies at the bedside. His lectures as professor of the theory and practice of medicine at the College of Physicians and Surgeons combined the observations of a scientist with the analytical judgment of a keen clinician. His diagnostic ability had a mathematical method which followed a thorough study of the relative frequency of diseases as had been formulated by Dr. Louis, of Paris, in the middle of the nineteenth century. Janeway was a typical clinician of the old school. His diagnoses were famed throughout this larger metropolitan district and known as far as his students wandered from their home school, the old Bellevue Hospital Medical College, to settle throughout this country and practice medicine as they had been taught by their honored teacher in the clinics and at the bedsides of Bellevue Hospital. Janeway's

[1] Address delivered to the graduating class of Cornell University Medical College, June 7, 1928.

diagnostic ability was founded on the broad foundation of hard work in the autopsy room and enhanced by a sort of roving commission to be the chosen consultant of every interne in Bellevue, to see every case of doubtful causation or of difficult diagnosis in any ward of any division of that celebrated hospital. Polk practiced an entirely different branch of medicine and left his mark on Bellevue Hospital as surgeon and obstetrician. In his earlier career he came under the influence of one of the greatest physicians of his day in this city, John T. Metcalf, and Polk became a physician of broad philosophy and keen appreciation of the whole science of medicine, although he limited his work to a specialty. This association and training had much to do with the development of his natural ability to become an educator of broad vision and the dean of this college.

Polk, Delafield and Janeway will never be forgotten whenever the history of medicine during the last twenty years of the nineteenth and the first ten years of the twentieth century shall be reviewed and written. There was a common characteristic of these three leaders, rivals though they may be considered, in medicine of forty years ago. They all stood for traditions of the past, for the brotherhood of the profession, for the individualism of the family doctor. But these personal qualities were not peculiar to such leaders in the art of medicine as the three I have selected as outstanding examples. The majority of the physicians of the nineteenth century were men of the same stamp, and such leaders as Polk and Janeway and Delafield were pushed into their preeminent position not by their own estimation of their ability, but by the general demand upon their time from their confrères that they consulted, so that there was no time left to them for the regular visitation of the ill in family practice. I wish to emphasize the fact that it is the physician of the nineteenth century who has been forgotten and that the leaders of the profession of that day are remembered for the brilliant achievements and not for the philosophy of their lives which they shared with the large majority of their colleagues. I wish to emphasize that the medical men of fifty and sixty years ago were family doctors because of their environment and of the general state of medical knowledge and that their successes depended largely on their character and personality.

It was often said of these men that they worked hard and died poor, and so they did. They make up the army of the forgotten physicians. It were well if some of the ideals of these men were still more in evidence amongst us. Your methods of practice will not be theirs; they knew only the beginning of modern bacteriology with its serums and inoculations and foreign proteins, and yet they put smallpox off the medical map and developed aseptic surgery. Their methods were the best that medical knowledge provided and they were specialists in making their patients comfortable. You must learn to practice the art of medicine to that same end and remember the homely details of caring for the sick and not limit your therapeutics to so-called specifics and autogenous poisons, misnamed vaccines. Not only is the type of physician I am trying to portray forgotten, but his materia medica is likewise forgotten. Pharmacology has taught us that many of his favorites have little worth, but many others are neglected nowadays in spite of their real value. It is a greater neglect to-day that the writing of a particular prescription to meet the individual indications of a single patient is a lost art. Let me warn you against the almost universal habit of prescribing ordinary remedies by numbers from some hospital formulary, or from the trade list of tablets of some wholesale drug firm, and I regret the giving to every patient with a cough even the bronchitis tablets of Delafield or to every anemic person the formula for the tartrate of iron frequently used by Janeway. Let me warn you against the insidious, glib-talking representative of the manufacturer of proprietary mixtures of known contents, or even of patent medicines of unknown composition. It has been one of my grim amusements in recent years to be talked to by agents of this class whom I recognized as old students of mine whom I, when a dean, prevented from becoming doctors and changed their occupation from fooling their wished-for patients to trying to cajole the physicians who were their former and more intelligent fellow students. Be an individualist and learn to mix your drugs with brains, and avoid the use of multiple mixtures, the so-called shotgun prescription. This error has crept into the giving of modern specifics and resulted in treating acute infections with the dead germ vaccines of multiple diseases from which the patients do not suffer.

The forgotten physician possessed a sense of humor and there is much help in observing the foibles of mankind from such a viewpoint. He cultivated a philosophy which led him to meet the grave and gay, the cure of most of his patients and the death of some, with equanimity, provided he could feel that he had done his best for their cure and comfort. On no other basis can any one practice the art of medicine. If a physician can be sure of his diagnosis and that he has done his best, he can temporarily forget the very sick case and give of his best to every other case, concentrating on each in turn and, dismissing all and their worries from his mind, sleep soundly at night.

The older physician of the early nineteenth century was a specialist in no branch of his art but a master of all in so far as human knowledge permitted. He was surgeon and internist, obstetrician and oculist, a general practitioner in fact as well as in name, and his reputation has endured. Before the discovery of anesthesia and of aseptic surgery, he, as McDowell in Kentucky, performed a successful ovariotomy; as Jenner in England he discovered the interrelation of cowpox and smallpox; as Laennec in France he discovered auscultation and as Auenbrugger in Austria he practiced percussion. The forgotten physician of the later nineteenth century became a specialist by preliminary hard work in general surgery and internal medicine. He was a doctor of medicine before he was a specialist. He knew nothing of the modern mischief of specialism. We are threatened to-day with specialization even of our medical students, and much harm has already been done by this pernicious theory of education of allowing one to study only that in which one is specially interested. As applied to medicine at least, the basic groundwork of the specialist is neglected. I have known of laparotomies begun by specialists, and because the disease found was not as diagnosticated and did not belong to the specialty of the operator the operation was left unfinished to be completed by a general surgeon. I met last summer on a steamer bound for Europe some seventy odd modern specialists making a tour to Vienna for a six weeks intensive training. This trip was the seventh annual pilgrimage under the same instructor for the same purpose. Far be it from me to belittle the attempt of any physician to improve his skill and add to his knowledge, but I must confess to a shock when I met some of the returning pilgrims two months later and found that their chief interest in the expedition was centered in the increased fees they expected to charge for their services in the future.

The forgotten physician was not troubled with the modern errors of commercialism which are creeping in all too fast to lower the standards and corrupt the inherited ideals of our profession. Professional fees were formerly on a sliding scale because the forgotten physician always maintained that the poor were entitled to free service not only in hospitals but in their own homes. Lawsuits for the collection of medical fees in the eighteen fifties and eighties were practically unknown. The modern view that if the poor demand the time of a physician without remuneration the rich must be called upon to pay for the same is vicious. It it quite proper to scale a physician's fees down for the moderately well-to-do, but it is not good ethics to scale them up in proportion to the largest income of the very rich. Much has been printed of late concerning a questionable practice known as the splitting of fees. Investigation has shown it is more widespread than it was supposed to be and that it is endorsed more or less publicly by some members of the profession. It is conceived in dishonor, it is carried on in secret, it involves the payment of money to one person for the unknown benefit of another; it is a secret system of bribery to further a consultation or special practice on the one hand, and of graft to increase a professional income at the expense of an exploited patient on the other. By these facts it carries its own condemnation.

You have spent six years at least in preparation for this ceremony. You have worked hard, and that you are here to-day means that you have learned to work and to think in medical terms at all times when awake, and to dream medicine when asleep. But your job is only begun. You must never cease to study, to read medicine, to observe the scientific facts of the laboratory and the clinical pictures at the bedside of the sick. You must correlate and apply the findings of chemistry and physics, of physiology and of pathology to the diagnosis and treatment of disease. It was no mere chance that brought success to Banting in the discovery of insulin nor to Murphy and Minot in the application of a diet of liver to the cure of pernicious anemia.

You can not all be Polks or Janeways or Delafields, but you can aim at the standards set by these leaders, and you will go further if you do than you otherwise might. Thereby you will escape the pitfall of modern commercialism; the seduction of a too early specialization; the enticement of stupid short cuts to knowledge; the lure of a smug acquiescence in a diagnostic conclusion in spite of the development of new facts, and the laziness of a stubborn adherence to an opinionated therapeutics against the advice even of a younger man, and when you find yourself in professional error you will frankly and promptly admit it.

Do not forget that medicine has a past which antedates any of the religious sects of to-day, that the ethics of the profession antedate Hippocrates, who formulated them, that even your grandfathers in the profession, the forgotten physicians, were celebrated men who lived lives of worth and honor and who accomplished much with less technical knowledge than you possess but with an appreciation of human nature and of men and women second to no modern M.D. with all his new-fangled nomenclature of the analysis of the psyche and the soma derived from misapplied Greek and Latin roots.

Live your lives and practice the art of medicine as did your predecessors of two generations ago and

you will enjoy a life full of service to those in trouble, you will be remunerated according to your deserts, you will always be able to look ahead with something still to do, something still to learn, something still to be discovered.

And now at the end of your novitiate, at the beginning of your real career, it is my pleasure to join with your faculty and your medical friends and to welcome you as fellow members to our profession.

Samuel W. Lambert

New York Academy
of Medicine

A RESEARCH DELUSION[1]

With the administrative heads of many of our educational institutions demanding a doctorate of every member of the permanent staff, as it is supposed to be a prerogative for research, and the issuing of a list of titles published each year by their staff, the urge for so-called research, namely, a list of titles, goes madly on. In fact publication sometimes becomes a sort of self-defense, for the absence of any titles over a brief period of years stamps one either as lacking the ability of doing research or inefficient. Likewise, such a policy has permeated the staff, so that their interest is centered in output rather than in quality. This is just another characteristic symptom of megalomania, so prevalent in our day in most lines of endeavor. I think that on an occasion of this kind a brief period can be profitably spent in analyzing the present tendency in research in order that we may have a better understanding of what actually constitutes research.

Research consists of more than the mere accumulation and publication of facts. Research in its highest aspect is something creative, akin to the well-known masterpieces of art, music and literature. A masterpiece is the product of the artist's mind, in that any one using the same oils and paints could not create a similar picture. The same creative urge is shown in music and literature. It is true that the scientist can not create any new material thing, but neither does the painter use anything in the way of materials other than those available to any one. However, the master scientist can so arrange his materials and facts that they represent a fundamental contribution to science as a painting does in art. As in art a masterpiece may go unnoticed for years, so in science the true value and significance of a contribution may escape attention for decades, but once its proper value is ascertained it persists for ages.

[1] Address of the past president of the Nebraska Academy of Science, Fremont, Nebraska, April 27, 1928.

It is rather disconcerting to listen to classical music and to realize suddenly that the melody transposed and in quickened tempo forms the basis of the latest jazz hit. The same feeling comes over one after reading an article to find that, although some new data are added, it is just a transposed rendition of some old familiar contribution. As in the arts, music and literature there are too many imitative and not enough creative minds. It is impossible for us all to become creative scientists, but we should at least strive towards this goal.

The English cleric who recently suggested that all active research be abandoned, for a period of ten years, had in mind, I think, that too much work was being repeated and the period of inactivity would bring us to a realization of the futility of doing research without an adequate understanding of what has previously been accomplished. An analysis by a master in his field of all existing data in his specialty would advance research much faster than the addition of more data during this period. As a merchant takes stock once a year and balances his accounts to see what progress has been made, so should we take stock at intervals of all the endeavors in our special field of science. A carefully digested inventory of the investigations in our field can not but lead to research of a higher standard. Not only do we fail to digest properly the publications of previous workers, but we are so intent on the mere collection of data that we do not take the time to weigh our data in their broad relationships.

It is true that from an economic standpoint the collection of new facts has yielded large returns, but soon, unless some precautions are inaugurated, having been so thoroughly sold on the benefits of scientific endeavors, the public will expect the impossible. Have the contributions of science to the progress and development of civilization made us a better and more cultured people? Scientific discoveries have no doubt given us more leisure than the world has ever known before. Are we producing any great works of art, music or literature in our times as the result of this leisure?

Perhaps at this point it might be well to review the history of science and attempt to determine how fundamental discoveries were brought to fruition. It is well known how the philosophical theories of Aristotle permeated the thought of Europe for centuries. While many of Aristotle's observations are sound, his deductive reasoning on natural phenomena probably more than any other factor held in abeyance the adoption of the experimental or inductive methods in science. Galilei, on the other hand, after much thought propounded his theory of falling bodies and

was able to prove experimentally that his deductions were correct. The discoveries of Newton, Faraday and others are very striking in that they propounded fundamental laws on what would now be considered very meager data. I am inclined to believe that their profound knowledge of mathematics was a great aid in arriving at the conclusions they did with so little data. Darwin, however, went to the opposite extreme and amassed a large amount of data over a long period of years before he announced his theory of the origin of species. One could cite numerous examples of the thought that was given to the interpretation of data before it was offered for publication.

The present tendency is to accumulate a superabundance of facts and data and devote too little time and effort in the proper correlation and interpretation of them. It is high time that we do relatively more thinking and less investigating if we are to maintain the high standards which have been set up for us by the past masters of science.

How are we to attain the goal of creative research? This question can not be answered any more easily than one can explain the production of a masterpiece in art, music or literature. However, it is possible to discuss some of the avenues which might lead to creative research. I am sure that when we began our careers in the sciences we were prompted to do so either through curiosity, humanitarianism, personal vanity, imitation or some such motive. Whatever this urge might have been originally, without it I doubt if any of us would spend the energy we do in research. In more ways than one this incentive is like a mirage, always in the distance, but for some reason or other we are never quite able to catch up with it. This failure to catch and hold a creative thought is partly due to the fact that we are not real dreamers or good philosophers. We are so busy collecting facts that we fail to give them much thought. Have you ever analyzed where your ideas originate? You will frequently find that it is during moments of relaxation, when the problems demanding your working energy are farthest from your thoughts. It is seldom that the most constructive thinking is done while busily engaged in the laboratory. More relaxation and reflection would be much more advantageous in solving problems than the mere collection of more data. With relaxation and reflection our subconscious mind might function and flash to us in an instant the clues which we were vainly groping for while in the laboratory.

Even if we ourselves fail to do creative research we can stimulate the rising generation of scientists to hunger for the goal and in this fashion make our contribution to the advancement of science. It should be the chief aim of the teacher in his contact with students to direct and stimulate them to thinking, rather than to fill their minds with masses of unrelated facts, which are always available, providing they have been taught where to find them. Convenient and accessible libraries should be built up, even at the expense of the laboratory, and students taught to use books constantly, as they would indispensable methods in the laboratory. Our graduate students for the most part have access to too much work and thought evading equipment. It is really surprising what can be done in the way of substantial research without costly apparatus. It is only necessary to refer back to the old masters of science to substantiate this statement.

Let us therefore stop deluding ourselves. The aim of research is not solely the accumulation of facts for immediate publication, so that we may in vainglory point to our output for the year. We must strive to do more constructive thinking and especially give our minds an opportunity to function through proper relaxation. We shall not advance fundamental science if we are simply busy collecting data. With more constructive thinking on our problems there would be fewer but better publications, an era without doubt we should all sincerely welcome.

GEORGE L. PELTIER
UNIVERSITY OF NEBRASKA

RECENT DEVELOPMENTS IN QUANTUM MECHANICS[1]

THE fundamental fact for quantum physics which has emerged from experimental investigations in the field is a double duality of wave and particle concepts. The wave theory of light, firmly grounded by the wave explanations of interference and diffraction and by Maxwell's electromagnetic theory of light waves, is now recognized as giving but one aspect of the nature of radiation. The corpuscular aspect of radiation is revealed in the photoelectric effect and in the Compton effect. In these effects Planck's constant appears as a universal constant which connects the wave and particle modes of description of the same radiation.

The radiation which functions as a wave disturbance of frequency ν waves per unit time, and as having a wave number of σ waves per unit length, when interference and diffraction phenomena are being discussed, also functions as a mechanical corpuscle of definite energy, E, and momentum, P, when effects like the photoelectric and Compton effects are considered. The connection between the quantities, ν, σ,

[1] Based on a lecture delivered on July 19, 1928, before the summer school for engineering teachers of the Society for the Promotion of Engineering Education at the Massachusetts Institute of Technology, Cambridge.

E, and P, given by experiment is contained in the equations:

$$E = h\nu, \quad P = h\sigma.$$

(Note that the equations are made more symmetrical by using σ, the wave number, instead of its reciprocal, the wave-length, which is more commonly used.)

The duality is made double by recent discoveries concerning the electron. The most direct are those of Davisson and Germer, reported in the *Physical Review* for December, 1927. In their experiments a beam of electrons is scattered from the direction of normal incidence on a single crystal of nickel. It is found that there are certain directions of strong scattering and that the location of these directions can be quite closely represented by assuming the scattering to be governed by laws of wave interference, exactly parallel to the wave interpretation of the diffraction patterns formed when X-rays are scattered by a crystal. The association of wave and particle concepts which holds for radiation is also seen to hold for electrons in these experiments, for when the mechanical momentum is varied the wave-number or wave-length effective for diffraction of the electron beam varies in just the manner given by the equation, $P = h\sigma$.

Instead of trying to go back of this duality, quantum mechanics is attempting to give a self-consistent mathematical development to the phenomena of quantum physics, which recognizes the duality as fundamental. The recognition of a wave-length associated with the motion of electrons really antedates the Davisson and Germer experiments, going back to de Broglie's wave interpretation of Bohr's rule for picking out the stationary states in atoms. In Bohr's theory of the hydrogen atom, it is postulated that circle orbits of just certain discrete sizes are possible, the rule being that the angular momentum of the orbit must be equal to an integral multiple of $h/2\pi$. De Broglie recognized in this rule an analogy with the discrete modes of vibration of a stretched string. Such a string when fastened at the two ends may vibrate only in ways which make the wave-number of the standing waves be an integral multiple of the length of the string or in a superposition of several of these modes of vibration. If there is some kind of wave motion associated with a moving electron, it is then natural to suppose by analogy that the wave-number of the waves must be an integral multiple of the circumference of the orbit. One may readily see that this leads to the same choice of orbits as did Bohr's rule, when the fundamental connection, $P = h\sigma$, is assumed. It has the advantage that it gives some inkling of the reason for the existence of stationary states.

Schrödinger's contribution lay in the mathematical development of this idea. Working by analogy with the theory of propagation of elastic waves he set up a partial differential equation for the propagation of the waves associated with an electron which has had extraordinary success in dealing with quantum phenomena. His work was in no way a derivation by strict logical steps from previous knowledge of what this equation must be. In fact, it is now recognized that his equation is a simplified form of other equations for the waves discovered by Dirac this year. The correction given by Dirac is a small one so far as numerical magnitudes go but an important one in that it puts the magnetic effect of the electron spin into the theory in a rational way.

Whenever there are waves having a wave amplitude propagated in space and time one must have a physical understanding of the wave amplitude or quantity which does the waving. In the electromagnetic theory of light this wave amplitude consists of two vectors, the electric and magnetic forces, which are recognized physically by the forces which they exert on electrified or magnetized bodies placed in the field. When physical reality is attributed to the corpuscular light quanta, one must still find a way in which the wave field is important. Einstein suggested that the electromagnetic field determines the relative probability that the quanta go to different places. In a set of interference fringes, the wave amplitude is strong at some places and weak at others. The quanta go to the different places with a relative probability that is given by the wave measure of the intensity, namely, the square of the wave amplitude.

In attempting to provide an interpretation for the wave amplitude Schrödinger supposed that when in an orbit an electron does not remain a little particle of negative electricity whose radius is of the order of 10^{-13} cm, but spreads out and fills a larger region of space with a volume distribution of charge. The total amount was just the charge on an electron, but the electricity was thought of as being actually smeared out over a region of space which is of the same order of magnitude as the orbits on Bohr's theory, therefore more like 10^{-8} cm. Against this view can be urged that in dealing with the free particle, the wave associated with a freely moving electron on Schrödinger's theory fills all space uniformly: there is not much left of an electron which is so smeared out that it fills all space uniformly.

Recognizing this difficulty in connection with problems involving the motion of electrons free from atoms, Born carried over Einstein's idea concerning the electromagnetic field as a probability field for the positions of the light quanta. He supposed the square of Schrödinger's wave function to give not

the actual charge density arising from a smeared-out electron, but the probability of finding the corpuscular electron in the different parts of space. This view has been the basis of the developments due to Dirac and Jordan which have given a much more general form to the mathematics of quantum mechanics.

This interplay of wave and particle concepts which makes the wave field serve as giving the probability of different positions of the particle or particles governed by the wave field implies a fundamental limitation on the precision of certain physical quantities, a point which has been emphasized by Heisenberg and by Bohr. (See especially Bohr's article in *Nature* for April 14, 1928.) A plane wave of infinite extent is to be associated with a particle of which the momentum is exactly known. The infinite extent of the wave in turn means that the particle is equally likely to be anywhere in space. That is, exact knowledge of the momentum implies absolute ignorance concerning the position of the particle. By superposing waves of different wave-lengths, it is possible to have the different waves interfere everywhere except in a certain small region of space. Such a group of waves is taken as the wave representative of a particle *of which it is known* that the particle is in this region of space. It follows from the laws of wave interference that the smaller the region in which the waves do not destructively interfere, the greater the range of wave-lengths which must be represented in the different plane wave constituents which are superposed to make up the group. Recalling the connection between wave-length or wave number and momentum, it is seen that such a group of waves, which represents a particle known to be in a certain region, implies a range of values of the momentum or a lack of precision in the knowledge of the momentum. The size of the region in which the particle is known to be located may be thought of as the uncertainty of our knowledge of the position of the particle. The range of wave-numbers in the constituent waves of the group measures the associated uncertainty in the momentum of the particle. Calling Δx, Δy, Δz the uncertainties in positional coordinates and Δp_x, Δp_y, Δp_z the uncertainties in the momentum components, the laws of wave interference, together with the quantum law of association between the concepts of wave number and momentum, give the equations:

$$\Delta x\,\Delta p_x \gtrsim \frac{h}{2\pi}, \quad \Delta y\,\Delta p_y \gtrsim \frac{h}{2\pi}, \quad \Delta z\,\Delta p_z \gtrsim \frac{h}{2\pi}$$

If the laws of wave interference really do govern the motion of particles this implies that our simultaneous knowledge of the position and momentum of a particle may never be so precise that the product of the uncertainty in a coordinate multiplied by that in the associated momentum component that the product of the two uncertainties is less in order of magnitude than Planck's constant, h. A consideration of various methods of measuring simultaneously the position and momentum of a particle has indicated that all physical measurements are really subject to this fundamental limitation. This point is likely to prove of considerable interest to philosophers. It appears that in the concepts of position and momentum we are confronted with two quantities, either of which may be given a precise definition when considered alone, but when considered together there is a correlated vagueness about their magnitudes which appears as a fundamental law of nature.

In conclusion, it may be well to point out that the reason that the classical laws of mechanics prove to be so satisfactory for macroscopic things is that the wave-lengths of the wave phenomena for them are so small that diffraction effects are negligible, just as in many problems concerning light it is admissible to ignore the wave nature of light, as is done in geometrical optics. The laws of classical mechanics bear the same relation to those of quantum mechanics as the laws of geometrical optics bear to the wave theory of light.

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SCIENTIFIC EVENTS

CONFERENCE OF THE BRITISH ASSOCIATION ON THE PRESERVATION OF SCENERY

THE London *Times* says that the detailed work of the British Association is carried out in 13 sections, lettered from A to M, and one "conference," a gathering of delegates from 160 societies in correspondence with the association. Partly owing to the accident that this gathering is not named and lettered as a section, its proceedings have hitherto received something less than their due share of publicity. On the occasion of the Glasgow Meeting of the British Association the conference will constitute itself in fact, if not in name, a section dealing with the Science of Scenery.

Dr. Vaughan Cornish in his presidential address pointed out that the special responsibility of learned societies in regard to the preservation of scenery is to discover and define the combinations which result in scenic beauty, and thus provide a secure foundation for an esthetic of scenery.

Mr. C. R. Gibson, representing the Royal Philosophical Society of Glasgow, will move that it is

desirable that the British Association should urge his Majesty's Government to stimulate the employment by local authorities of the powers already conferred upon them by Parliament for the preservation of scenic amenity in town and country. The motion will be seconded by Mr. T. Sheppard, representing the Museums Association, and Miss R. M. Fleming, of the Cardiganshire Antiquarian Society, who will deal especially with the concern of Wales in this matter. Lord Crawford and Balcarres, chairman of the Council for the Preservation of Rural England, will speak in support of the resolution.

The second and concluding session of the Conference of Corresponding Societies, to be held on Tuesday, September 11, will be devoted to the scenery of the English Lake District and its preservation. The subject has been chosen for treatment on this occasion because the Lake District is the most significant scenic region in Great Britain, not only on account of its unusual combination of fine natural features and of certain advantages for rambling which result from the social and economic conditions of the district, but also because it is inseparably connected with the prophetic inspiration of one whose interpretation of nature is of unique importance to readers of English poetry.

Dr. Hugh Mill, vice-president of the Royal Geographical Society, will describe the geography of this well-defined scenic region. The next speaker will deal with "Wordsworth's Interpretation of Nature," after which Mr. Ewart James, of St. Bees, Cumberland, will give a detailed account of the elaborate scheme of regional planning for the preservation of scenic amenity in the Lake District and its environs which is now under the consideration of numerous local bodies.

RESEARCH ON AIR NAVIGATION

DR. GEORGE WILLIAM LEWIS, director of aeronautical research under the National Advisory Council, in proposing the formation of the subcommittee on problems of air navigation, as announced in last week's issue of SCIENCE, presented the following outline for its work:

1. It has been brought to my attention that there is need at the present time for the coordination of scientific research being conducted on the problems of instruments for air navigation, aerial communications and meteorological problems of air navigation, especially landing in fog.

2. The importance of coordinating these activities has been called to my attention particularly by representatives of the Daniel Guggenheim Fund for the Promotion of Aeronautics and the American Telephone and Telegraph Company. To provide aids to air navigation is a function of the Department of Commerce.

The coordination of scientific research for the providing of such aids is considered to be properly a function of the National Advisory Committee for Aeronautics, and can be so interpreted from the act establishing the committee, which states it shall be the duty of the committee "to supervise and direct the scientific study of the problems of flight, with a view to their practical solution, and to determine the problems which should be experimentally attacked, and to discuss their solution and their application to practical questions."

3. Commander Hunsaker, of the American Telephone and Telegraph Company, has advised me that his company is conducting research on aerial communications, especially in connection with the navigation of aircraft and the communication of weather reports. He has found that the researches being conducted along lines in which he is particularly interested are rather wide-spread and varied, and that there is no organization at present that is coordinating this work in a manner similar to the functions of the Aerodynamics Committee and other subcommittees in other fields of aeronautical activity. Among the organizations at present conducting research along the lines of aerial communications are the American Telephone and Telegraph Company, the Bureau of Standards, the War Department, the Navy Department and the Radio Corporation of America.

4. The Guggenheim Fund organized, under the direction of Admiral H. I. Cone, a committee to study the problem of fog landing. The committee included in its membership representatives of the various government organizations concerned with the problem, the purpose being to coordinate the efforts of the various investigators along this line with a view to the making of definite recommendations as to what the Guggenheim Fund could do to aid in the solution of this particular problem.

5. Admiral Cone also brought to my attention the importance of coordinating the work of government organizations and manufacturers in fundamental investigations leading to the development of better and more accurate aerial navigation instruments.

6. There is a feeling on the part of every one connected with aeronautics, both in the government services and in outside organizations, including the manufacturers, that the committee has discharged its function of coordinating fundamental research in a very praiseworthy manner with reference to aerodynamics, power plants and materials for aircraft.

The time has now come when the problems of air navigation, particularly meteorological problems, aerial communications and navigational instruments, are of the utmost importance, and the coordination of fundamental research in connection with these projects is properly a function of the National Advisory Committee. It is, therefore, recommended that a Subcommittee on the Problems of Air Navigation be organized, to include in its membership representatives of those agencies particularly interested in these problems, both in the government services and outside the government.

THE ARNOLD ARBORETUM

FROM a statement issued by the U. S. Department of Agriculture we note that a new and larger greenhouse is to be erected at the Arnold Arboretum of Harvard University, at Jamaica Plain, Mass. In this greenhouse, which will occupy a site on the South Street side of the arboretum, there will be a laboratory fully equipped for research in pathology and genetics, a workroom for potting and pits for growing woody plants. The greenhouse will be about 50 feet long. It is to be adjoined by a new nursery covering about three acres of land.

A most important phase of arboretum work—hybridization and the study of living conditions and diseases of plants with a view of improving their inherent qualities—has never been attempted at the Arnold Arboretum because of lack of necessary facilities. Up to the present time the work carried on at the arboretum has consisted mainly of assembling woody plants and trees from all parts of the world, identifying, classifying and propagating them and exchanging them with other arboreta and nurseries and building up a library and herbarium.

With part of the $1,000,000 endowment now being raised as a memorial to Charles Sprague Sargent, late director of the arboretum, two departments of research are to be established, one in pathology and one in genetics. The work in genetics will be supervised by Dr. Edward M. East, of the Bussey Institution. There is to be added to the staff a systematic botanist whose field will cover the woody plants of tropical America. It is planned to offer opportunity for special work in dendrology to men who wish to obtain the doctor's degree in this field.

The Arnold Arboretum was established in 1872 for the study and cultivation of all woody plants capable of withstanding the climate of Massachusetts. The original endowment was $100,000, given to Harvard University by a local merchant. In carrying out this trust Harvard set aside 125 acres of land known as the Bussey farm. By an arrangement with the city of Boston the Arnold Arboretum is assured of its present site for 1,000 years and is tax free. The roads in the arboretum are maintained by the city as part of the park system. Under Professor Sargent's guidance the endowment was increased to more than $1,000,000 and the area to 260 acres. The arboretum now includes more than 6,500 species of trees, shrubs and vines.

Of the projected Sargent memorial fund of $1,000,000 more than $900,000 has been collected.

THE SWAMPSCOTT MEETING OF THE AMERICAN CHEMICAL SOCIETY

THE seventy-sixth meeting of the American Chemical Society will be held at Swampscott, Massachusetts, from Monday, September 10, to Friday, September 14. It is estimated that more than 2,000 chemists will be in attendance. A list of the large number of technical papers to be presented before the society will be found in the news edition of *Industrial and Engineering Chemistry* for August 20. The following special arrangements have been made by various divisions:

The Division of Agricultural and Food Chemistry will hold a symposium on "Chemistry and the Food Industry."

The Division of Biological Chemistry is preparing an extensive program on various phases of the relation of chemistry to health and disease, covering vitamins, irradiation, endocrinology, bacteriology, etc. Special attention will be paid to cod-liver oil, the rôle of diet in dentition and chemical phases of psychiatric conditions.

The Division of Chemical Education will hold a joint symposium with the Division of Physical Chemistry on "The Teaching of Physical Chemistry." In addition, there will be a breakfast of the executive committee of the division at the New Ocean House, Monday, at 8 A. M.; a meeting of the Senate of Chemical Education at 9 A. M.; luncheon for the senate and the division at 12:15 P. M., and a luncheon, to which high-school teachers of chemistry in the immediate area of the meeting are especially invited, at 12:15 P. M., Tuesday. There will be a meeting of the contributing editors of the *Journal of Chemical Education*, Wednesday at 5 P. M.

The Division of Colloid Chemistry will hold a joint symposium with the Rubber Division on "The Colloid Chemistry of Rubber," and two additional half-day sessions.

The Dye Division will hold two sessions of special interest to the textile industry, and a third session devoted to the spectrophotometer.

The Division of Gas and Fuel Chemistry will hold a joint symposium with the Division of Petroleum Chemistry on "The Chemistry and Physics of Combustion," and two additional sessions for general papers appropriate to the Division of Gas and Fuel Chemistry.

The History of Chemistry Division will hold a half-day session, at which several papers will be devoted to the history of chemistry in New England and, in connection with the centenary of urea, a discussion of Wöhler and an exhibition of Wöhler memorabilia. The division plans an exhibition, open continuously for two days for the convenience of the members of the society, of books, letters, portraits and other documents pertaining to the history of chemistry in New England.

The Division of Industrial and Engineering Chemistry will have charge of one of the general programs on Tuesday morning and will also hold an economic symposium on "The Newer Relations of Nitrogen to Chemical Industry and Agriculture."

The Division of Petroleum Chemistry is planning two symposia for the Swampscott meeting: a symposium on "Wax" and a joint symposium with the Division of Gas and Fuel Chemistry on "The Chemistry and Physics of Combustion."

The Division of Physical and Inorganic Chemistry will have charge of one of the general sessions and will also have a joint symposium with the Division of Chemical Education on "The Teaching of Physical Chemistry."

The Division of Rubber Chemistry is arranging a joint symposium on "Polymerization."

The council has voted that the policy of the society regarding attendance and participation in its general, divisional and regional meetings shall be as follows:

(*a*) Attendance at meetings is limited to registered individuals.

(*b*) All individuals in registering shall state whether or not they are members of the society and, if not, whether they are chemists.

(*c*) American chemists non-members of the society shall assist in the support of the facilities which they enjoy by paying a higher registration fee than members. This differential at general meetings shall be $5.00 higher than the fee charged members; while at regional and divisional meetings it shall be at least twice the regular fee adopted. They shall be furnished with a special non-member badge to differentiate them from members of the society and from foreign and non-chemist guests. The differential charged shall not apply to regularly matriculated students majoring in chemistry at any college or university.

(*d*) Papers by American chemists not members of the society shall not appear on its programs unless they be joint papers with society members.

Swampscott is one of the leading summer resorts in the Boston territory, and is ideally situated on the famous "North Shore." Visitors will combine the pleasures of the seashore with the attractions of the metropolis in enjoying a recreational week as a background for the important scientific sessions. Among other features, the entertainment committee has arranged sightseeing trips for Tuesday and Wednesday, the formal banquet for Wednesday evening, a visit to Harvard University Thursday afternoon, and an all-day North Shore trip on Friday.

SCIENTIFIC NOTES AND NEWS

DR. GEORGE L. STREETER, director of the department of embryology of the Carnegie Institution at Baltimore, has received from the University of Dublin the honorary degree of doctor of science.

DR. FRANK B. JEWETT, of the American Telephone and Telegraph Company, and Dr. William Allen Pusey, the dermatologist, of Chicago, former president of the American Medical Association, were speakers in a symposium on "The Community of Interest of the Professions," held in connection with the recent celebration of the fiftieth anniversary of the American Bar Association.

DR. W. HARVEY SMITH, of Winnipeg, has been elected president of the British Medical Association for the meeting to be held in Winnipeg in 1930.

PROFESSOR VLADIMIR IVANOVITCH KOVALEVSKY, of the State Institute of Experimental Agronomics at Leningrad, will shortly celebrate his eightieth birthday. By order of the Soviet government the title of "scientist emeritus" has been conferred upon him.

WILL C. BARNES retired on July 1 after completing twenty-one years with the U. S. Forest Service. Mr. Barnes, however, will not cease active work in the government service, but will assume the position of secretary of the United States Geographic Board.

DR. HOWARD D. LIGHTBODY, associate professor of physiological chemistry, Michigan State College, East Lansing, has been appointed director of the John C. Oliver Memorial Research Foundation, recently established at the laboratory of the St. Margaret Memorial Hospital, Pittsburgh.

DR. G. C. HAAS, of the foreign service of the U. S. Department of Agriculture, is leaving at the end of August to take a position with the Investment Research Corporation, of Detroit, Michigan.

DR. E. L. KIRKPATRICK, associate agricultural economist of the division of farm population and rural life, will resign from the bureau of Agricultural Economics on August 31 to accept a position in the department of agricultural economics at the University of Wisconsin, where he will be principally engaged in research work in rural sociology.

DR. NELSON MCKAIG, JR., following completion of postgraduate studies at the University of Chicago for the degree of doctor of philosophy, has been appointed associate soil technologist in the Bureau of Chemistry and Soils and has been assigned to research studies on soil fertility problems with sugar cane in the south.

CHARLES W. GILMORE, curator of vertebrate paleontology in the U. S. National Museum, after an absence of three months in the northern Montana fossil fields, resumed his work at the museum on August 13. He reports a successful season in the field, the expedition of which he was in charge having collected two and one half tons of material. Mr. Gilmore was assisted in the field by Mr. George F. Sternberg and Mr. Edwin Cooke.

CHARLES VERNON BOYS, F.R.S., the London physicist, is spending the summer as the guest of Alfred L. Loomis at the latter's laboratory in Tuxedo Park, N. Y.

WILLIAM CUTRIGHT, specialist on insects of the U. S. Department of Agriculture, arrived in Yokohama, on June 28, for a year's stay in Japan and other Asiatic countries. He will carry on research work in the Kyoto Imperial University on the

Japanese flies that kill the American corn borer, the pearl moth.

DR. CHARLES E. DECKER, of the University of Oklahoma, is spending two weeks in a study of the museum's extensive series of Oklahoma Ordovician fossils in collaboration with Dr. E. O. Ulrich, in order to work out a standard geologic section for the early Paleozoic rocks of that state.

DR. JEROME ALEXANDER addressed the Hawaiian Section of the American Chemical Society on June 30, on "Some Applications of Colloid Chemistry."

A MEMORIAL service in honor of the late Dr. Hideyo Noguchi was recently held in Tokyo. The opening addresses were delivered by Viscount Goto, Viscount Ishiguro and Viscount Ishii. Dr. Hata then spoke on Noguchi's work in general bacteriology and Dr. Doi on his work in tropical medicine. A survey of the life of Dr. Noguchi was given by Dr. Chiwaki.

IN connection with the preparation of a detailed biography of the late Charles Saunders Peirce, which will be issued with the edition of his collected works soon to be published by the Harvard University Press, Mr. Charles Hartshorne, of the university, requests that those who have in their possession letters or biographical material by or concerning Mr. Peirce will be so kind as to communicate with him.

A STATUE of the physiologist Vulpian, whose centenary was celebrated last year, has been erected in a street adjoining the Paris Academy of Medicine. It represents Vulpian in meditation, dressed in professorial robe. The statue is the work of a physician, Dr. Paul Richer, professor of anatomy at the École des Beaux-Arts, and a member of the Académie des Beaux-Arts.

GEORGE MARTIN DUNCAN, who for twenty years, until his retirement in 1923, held the chair of logic and metaphysics in Yale University and who had previously for fifteen years been a member of the staff, died on July 26 at the age of sixty-five years.

PROFESSOR E. M. CROOKSHANK, emeritus professor of bacteriology at King's College, London, died on July 1 in his seventieth year.

INFORMATION received by the U. S. Public Health Service through the Department of State contains an announcement that the ninetieth Congress of the Association of German Naturalists and Physicians will be held at Hamburg from September 5 to 22. This is the first time since 1901 that the meeting has been held at Hamburg. The eighty-ninth congress met in Düsseldorf. The program of the natural science section will include papers from the various departments of the natural sciences. Among the papers of the medical section are the history of the development of anatomy and histology, physiology and physiological chemistry, universal pathology and pathological anatomy, Röntgenology, surgery, ophthalmology, obstetrics and gynecology, pediatrics, neurology and psychiatry, dentistry, medical law and social medicine. In connection with the congress there will also be an exhibit relating to medical and natural science in the new exhibition hall of the zoological gardens and numerous inspections will be made of modern technical and domestic plants, such as incinerators, sewerage systems, gas works and water works.

OFFICERS and members of the Institution of Chemical Engineers of Great Britain were the guests of the American Institute of Chemical Engineers at its twenty-first semi-annual meeting held at Niagara Falls, Canada, August 24, 25 and 26. They will be the guests of the American society in a tour of important industrial centers in Eastern Canada and the United States, ending their trip in New York on September 2. Leading British engineers and industrialists who attended the meeting include Sir Alexander Gibb, G.B.E., C.B., president of the Institution of Chemical Engineers of Great Britain; J. Arthur Reavell, vice-president of the institution; J. W. Hinchley, professor of chemical engineering at the Imperial College of Science and Technology, London, honorary secretary of the institution; F. A. Greene, a consulting engineer in London; P. Parrish, chemical works manager of the Metropolitan Gas Company, London, and C. J. Goodwin, a consulting chemical engineer in London.

THE early establishment of a laboratory for the Gorgas Memorial Institute of Tropical Research and Preventive Medicine, in honor of the late General William Gorgas, has been assured by the visit to Balboa of Dr. Franklin H. Martin and Colonel Joseph F. Siler, who returned to New York on August 26 to complete final arrangements for the project. President Chiari has granted the use of a building intended for a medical school, until the laboratory shall be built by the Panama government. Colonel Siler, medical expert of the United States Army, is a member of the board chosen to select the personnel of the laboratory, the head of whom, it is desired, shall be a comparatively young man who has made a special study of tropical diseases and who gives promise of adding something of value to present knowledge, besides possessing executive ability. Funds are already available to begin the work, as a result of an appropriation by the United States Congress and of contributions from several Latin-American governments. The arrangements necessary for the preparation of the building of the laboratory have been completed,

and it is expected that the equipment for actual research experimentation will be available in a comparatively short time.

THE bureau of chemistry and soils of the U. S. Department of Agriculture, in cooperation with other bureaus of the department, has joined American apple and pear growers in warfare against the destructive armies of the codling moth by establishing field laboratories at Wenatchee and Yakima, Washington, where it is hoped to develop a poison that will be superior to the lead-arsenate spray which at present is the only effective method with which to combat this serious pest. C. R. Gross, an associate chemist of the bureau, will take charge of the chemical investigations, with the cooperation of Dr. L. A. Hawkins and H. C. Diehl, of the fruit-handling division, and Dr. Charles Brooks and D. F. Fisher, of the fruit-disease division of the Bureau of Plant Industry, and with E. J. Newcomer, of the Bureau of Entomology, in the effort to discover a poison deadly to codling moths, harmless to human beings, which will not require a wash or other treatment that will shorten the life of the apple when in storage.

BY the will of the late Miss Mary E. Soule, of Brookline, Massachusetts, the Entomological Society of America has received a bequest of $1,000.

THERE has recently been displayed in Education Hall of the American Museum of Natural History a loan series of fifty-two paintings and sketches by the late Albert Operti, Arctic and marine painter. These were loaned through the courtesy of a number of his friends, mostly members of the American Museum staff.

WE learn from *Industrial and Engineering Chemistry* that the U. S. Bureau of Mines, Pittsburgh, Pa., has recently completed a one-reel educational motion picture film, entitled "Carbon Monoxide: The Unseen Danger." This film, prepared in cooperation with a large automobile manufacturing company, shows how this deadly gas may be encountered in workshop, garage and home, points out ways of preventing accumulations of the gas and visualizes methods of reviving its victims. Schools, churches, etc., may use the film free of charge, by paying transportation costs.

THE budget estimates of the Russian government and the allied republics for 1927–28 provide for the expenditure of 491,000 roubles on pensions to aged scientific workers and their families. Together with the funds under the social insurance scheme, the sum will mount to 583,000 roubles. Out of these funds there will be pensions given to 626 people. Besides these special pensions, scientific workers are entitled to social insurance under the general scheme.

A CAMPAIGN for improvement of the health of the Filipinos is being planned by the Governor-General of the Philippines, Henry L. Stimson, according to an announcement by the War Department. An appropriation for the establishment of a school of hygiene and public health in connection with the University of the Philippines has been approved, it was stated. This is considered essential because there are few officers in the Philippine public health service who have had professional training in public health.

THE Michigan College of Mining and Technology is offering for the academic year of 1928–1929 twelve graduate fellowships carrying stipends of $1,200 each. Holders of these fellowships will be engaged in the study of various problems in connection with the general research program at the college for which the State of Michigan has provided the sum of $50,000 for the coming year. This program deals with the iron and copper resources of northern Michigan and with their utilization. Appropriate parts of this research program are conducted in cooperation with mining companies, the United States Bureau of Mines, the United States Coast and Geodetic Survey and the Carnegie Institution Department of Terrestrial Magnetism.

THE New York State Legislature appropriated $1,100,000 this year to finish the erection of the plant science building at the state college of agriculture at Cornell University. This building is to house the departments of botany, plant pathology, genetics and plant breeding, pomology and floriculture, with vegetable gardening adjacent. Foundations for the building were laid last year and the new appropriation is to complete the structure.

THE fifth International Botanical Congress was held at Cambridge, England, from August 16 to 23, 1930, with excursions during the following week. The congress was organized in the following sections: Paleobotany, morphology (including anatomy), taxonomy and nomenclature, plant geography and ecology, genetics and cytology, plant physiology, mycology and plant pathology. For each of these sections a British subcommittee was appointed, by which the program was arranged. The chairmen of these subcommittees are as follows: Paleobotany, Professor A. C. Seward, Botany School, Cambridge; morphology (including anatomy), Professor F. E. Fritsch, Danesmount, Tower Hill, Dorking, Surrey; taxonomy and nomenclature, Dr. A. W. Hill, Royal Botanic Gardens, Kew, Surrey; plant geography and ecology,

Professor A. G. Tansley, department of botany, the University of Oxford; genetics and cytology, Sir John Farmer, Imperial College of Science and Technology, London; plant physiology, Dr. F. F. Blackman, Botany School, Cambridge; mycology and plant pathology, Dr. E. J. Butler, Imperial Bureau of Mycology. Communications made to the congress by means of papers or by participation in the general discussions were permissible in English, French or German. Professor A. C. Seward was chairman of the executive committee.

PRESIDENT A. LAWRENCE LOWELL, chairman of the Commission on Medical Education, has appointed the following committees of the commission to deal with certain groups of problems before it: *Committee on Pre-Medical Training:* Chancellor Samuel P. Capen, *chairman,* University of Buffalo; Dean Henry G. Gale, University of Chicago; President Walter A. Jessup, University of Iowa; President Clarence C. Little, University of Michigan; Professor Leon B. Richardson, Dartmouth College. *Committee on Training in the Medical Sciences:* Professor Lafayette B. Mendel, *chairman,* Yale University; Professor John J. R. Macleod, University of Toronto; Professor Charles R. Stockard, Cornell Medical School; Professor George H. Whipple, University of Rochester Medical School; Professor Hans Zinsser, Harvard Medical School. *Committee on Clinical Training:* Dean David L. Edsall, *chairman,* Harvard Medical School; Professor George Blumer, Yale Medical School; Dean Hugh Cabot, University of Michigan Medical School; Professor Elliott Cutler, Western Reserve Medical School; Professor George E. deSchweinitz, University of Pennsylvania; Professor Charles P. Emerson, Indiana University Medical School; Professor Benjamin P. Watson, Columbia University Medical School. Dr. Willard C. Rappleye, director of study of the commission, is secretary of each of these committees.

ACCORDING to the *Archiv für Rassen- u. Gesellschafts Biologie,* reported in *Eugenical News,* the investigation of the problem of the origin of the Mongoloid racial elements is being studied by the expedition in Further India and to this end it has worked in Upper Burma and the Schan states. The leader of the expedition, Dr. Freiherr von Eickstedt, and his wife have made their headquarters in the town of Namhson at an elevation of 2,000 meters. Extensive material is being collected; ethnographic articles, 500 photographs and measurements on 230 men and women. The Chinese in the adjacent territory will also be studied.

BY recent executive order, President Coolidge has reestablished for the protection of native birds the Pathfinder Bird Refuge, embracing 22,700 acres on the North Platte River in central Wyoming. The area is set aside for the use of the department as one of the numerous refuges administered by the U. S. Bureau of Biological Survey. All the lands involved have been withdrawn for reclamation purposes in connection with the North Platte project, Wyoming, and are primarily under the jurisdiction of the Department of the Interior. The area includes mainly a reservoir constructed for the use of the Reclamation Service in the irrigation of lands. The establishment of this refuge furnishes nesting grounds as well as important feeding and resting places for the large numbers of migratory waterfowl, especially ducks, in a region where open-water areas providing a haven for birds are scarce. It is unlawful, within the refuge, to hunt, trap, capture, willfully disturb or kill any wild animal or bird of any kind whatever, or take or destroy the eggs of any wild bird, except under such rules and regulations as may be prescribed by the Secretary of Agriculture.

CARRYING authorization for an appropriation of $350,000, the Bear River migratory bird refuge bill, which has been pending in congress for the last two sessions, has been approved by President Coolidge. This important conservation legislation authorizes the Secretary of Agriculture to construct at Bear River Bay and vicinity, Utah, such dikes, ditches, spillways, buildings and improvements as may be necessary for the establishment of a suitable refuge and feeding and breeding ground for migratory wild fowl, and to acquire, by purchase, gift or lease, water rights and privately owned lands necessary for the purpose. Another conservation measure recently approved by the president is a joint resolution authorizing the secretary of agriculture to accept from James B. Munn, of New York City, on behalf of the United States, a gift of certain lands in Clayton County, Iowa, to become a part of the Upper Mississippi River Wild Life and Fish Refuge. These lands, totaling 488 acres in area and estimated to be worth thirty or forty thousand dollars, were donated to the government by Mr. Munn through his interest in the objects of the refuge.

ON July 30 President Coolidge signed a proclamation creating the Huron National Forest in Crawford, Oscoda, Iosco and Alcona Counties in the State of Michigan, and transferring to this forest a part of the lands formerly within the Michigan National Forest. It was thought desirable to give the name "Huron" to the new National Forest in order to avoid the confusion which comes from naming a National Forest after the state, when there are two or more national forests in the same state. The Huron National Forest contains a gross area of approximately

500,000 acres, of which about 200,000 is now owned by the United States and the remainder is either in private ownership or is owned by the State of Michigan. The National Forest Reservation Commission has authorized the acquisition by the Department of Agriculture of the privately owned lands and it is expected, therefore, that these will ultimately be purchased.

THE International Education Board of the Rockefeller Foundation has given $200,000 to the Paris National History Museum to house the botanical collections in a new building. The total cost will be $280,000. The French government will contribute the balance.

UNIVERSITY AND EDUCATIONAL NOTES

ROBERT LAW, JR., has raised the amount he contributed to the development fund of the University of Chicago to $200,000. This sum will be used as an endowment for a distinguished service professorship.

DR. EDWARD H. ROCKWELL, dean of the college of engineering of Rutgers University, has been appointed professor of civil engineering at Lafayette College.

GEORGE W. SWENSON, assistant professor of electrical engineering at the University of Minnesota, has resigned to become professor of electrical engineering at the Michigan College of Mines at Houghton, Mich. He will be head of this department, which has just been established.

DR. GEORGE L. ZUNDEL, of Yale University, has been appointed assistant professor of plant pathology extension at the Pennsylvania State College.

DR. JOHN L. ULRICH, of the Plant Research Laboratory of Lehn and Fink, Bloomfield, New Jersey, has been appointed head of the department of physiology at the Homeopathic Medical School, New York City.

IN the department of zoology of the University of Pittsburgh, the following changes in rank are in effect for the coming year: Robert T. Hance, from acting head to head of the department; P. W. Whiting, from assistant to associate professor; E. Alfred Wolf, from instructor to assistant professor; A. W. Kozelka, from instructor to assistant professor at the Erie Center; E. P. Jones, from graduate assistant to instructor at the Uniontown Center.

THE China Medical Board of the Rockefeller Foundation has appointed Dr. Max M. Zinninger professor of surgery at the Peking Union Medical College. Dr. Zinninger has been with the Cincinnati College of Medicine and the Cincinnati General Hospital for about six years.

THE retirement of Professor Diarmid Noël Paton from the chair of physiology in the University of Glasgow will take effect on September 30. The Secretary of State for Scotland has recommended the appointment of Edward Provan Cathcart to the vacancy. Professor Cathcart at present holds the chair of physiological chemistry in the University of Glasgow, to which he was appointed in 1919.

DISCUSSION AND CORRESPONDENCE

"CENTERS OF RESEARCH," A REPLY

IN a recent article in SCIENCE entitled "Centers of Research,"[1] Professor S. R. Williams discusses what he believes to be the paucity and mediocrity of research in some of our graduate schools and suggests a remedy. While we agree that in some schools the situation is unsatisfactory we are inclined to differ as to some of the causes and the remedies. Professor Williams ascribes this condition to the practice of dividing research students among several members of the departmental staff, and suggests that the remedy is to place the department of research under *one outstanding leader who alone will direct and supervise the research of all candidates for the Ph.D. degree in that subject,* in analogy to the condition in German universities.

In contradistinction to conditions existing abroad where the funds for the support of more than one full professorship in a single subject are rarely available, our recent demand for wholesale education has created a very different situation. In the first place, many of our larger institutions are adequately supporting not one professorship in a department, but several. The demand for men to occupy the positions in competition with the excellent industrial opportunities for able men has filled many of these places with men of an average poorer quality than in analogous positions in Europe. In addition to this, the administrations of universities are demanding productive research from these men and their students. The result is, as Professor Williams states, rather lamentable in some cases. It seems to us, however, that the situation has been painted a bit blacker than it really is, and certainly than it will be in the future.

American standards for the Ph.D. are being perceptibly raised. Agencies such as the National Research Fellowships and the Bartol Research Foundation are training the abler Ph.D.'s in research for periods of several years after they have obtained their degrees. This is furnishing the universities with a most excellent supply of tried and able young men to carry on and direct graduate research.

Again, while it may be true that the smaller insti-

[1] SCIENCE, Volume 68, p. 61, July 20, 1928.

tutions are able to support the researches of only one of the abler men in a department, this is not so of the larger endowed institutions nor of any of a dozen state universities. While on certain problems cooperative research by a group under the leadership of one man is the best line of approach, it is seriously to be questioned whether in general the advance of knowledge can be furthered in this manner as well as by the more independent operations of a group working, however, in intimate contact. Although there are occasional men of genius among the leaders, the great complexity of modern science makes it questionable whether any one such man is going to be able adequately to direct researches over a broad domain. In fact, there is a great danger in putting, so to speak, "all one's scientific eggs in one basket." Finally, from the viewpoint of students whose study is for one reason or another confined to a given university, the concentration of research in one general field is a disadvantage, and where a single leader has to direct the researches of some thirty graduate students the situation becomes impossible.

If one examines the situation in such leading research centers of physics as California, Chicago, Harvard, Johns Hopkins, Michigan, Princeton, etc., one finds that the *group* is the productive unit, and that *no one man* is directing the researches, even though one man may be primarily responsible as the administrative head and organizer of the group. In fact, we differ so far from Professor Williams as to believe that the road to the best results lies in the direction of *assembling a group of able productive men, each active in directing the research of graduate students.*

The chief cause of our failing in research, as partially indicated before, we attribute primarily to the dearth *in the past* of able, original, well-trained men. This, in turn, is due to our rapid expansion and to disregard of the importance of research on the part of the public, resulting in the failure to support it adequately or to draw into it the best talent. It is a universal comment of distinguished foreign scientists who visit us, "We do not understand how you are content to work with so little *research assistance,* so little domestic help in your homes and so little public recognition."

In conclusion we might suggest that the policy of a large university in building up good research departments should not necessarily be to get "lustre names" to organize and direct their researches (there are all too few of these, anyway), but to select the new members of its staff with an eye to their research productivity in possibly several lines, to stimulate and encourage them by giving them opportunity to work with graduate students, and to urge departments to cooperate in discussing and working over their research problems and projects.

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BLOOD PRESSURE DEPRESSION BY LIGHT IRRADIATION

IN a recent publication, Smetana[1] reports the results of experiments in which he used technique similar to that employed in a series of papers[2] on the effects of light from various sources thrown on the blood flowing through a quartz tube inserted in the carotid artery in etherized dogs; he reports three experiments on dogs and one on a cat in which a carbon arc was the source of radiation, with the result that there was an average depression of 25 per cent. in the blood pressure of the dogs and 57 per cent. in the cat. From these he concludes (p. 599) "that exposure of circulating blood alone to strong light produces no strikingly greater fall of arterial pressure than might be expected to take place following approximately two hours' anesthesia carried out in the ordinary light of the laboratory."

In my original papers there were reported the results of about two hundred experiments on dogs, and many of these have since been repeated for various purposes since that time with comparable results. In one of these papers was reported an extensive series of control experiments in which by no means as great depression of blood pressure occurred as in the irradiated animals. Smetana does not report any controls nor does he give any information as to current, size or nature of carbons, or the distance of exposure, all of which are important factors influencing photobiologic effects. It may be assumed, though he does not so state, that no condensing lens was used. In most of my experiments a quartz condenser was used, thus greatly intensifying the energy incidence.

While not questioning the major conclusions of his paper, it seems that his conclusion that my results have not been confirmed is not valid for the following reasons:

(1) He reports no control experiments.

(2) His experiments are too few in number.

(3) It is common experience that the dog's blood pressure may be maintained practically constant under ether for periods of as long as five hours with carefully controlled technique.

[1] Smetana, Hans, *Jour. Exper. Med.*, 1928, xlvii, 593.

[2] Reed, C. I., and collaborators. *Amer. Journ. Physiol.*, 1923, lxv, 477; *ibid.*, 1925, lxxiv, 511, 518, 525; *ibid.*, 1926, lxxv, 351, 616; *ibid.*, 1926, lxxvi, 54. *Arch. Phys. Ther.*, 1927, viii, 108.

(4) The experimental conditions in the two series are not comparable if his description is complete.

(5) Blood pressure depression by light rays has been demonstrated by many investigators, both experimentally and clinically, by a great variety of methods.[3]

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A MORPHOLOGICAL EXPLANATION FOR THE FAILURE OF NECTURUS TO METAMORPHOSE

THE feeding of thyroid and other substances that effect amphibian metamorphosis has failed to cause this change in Necturus. Such feeding readily causes *Ambystoma tigrinum* to metamorphose.

Comparison of the aortic arches of *Ambystoma tigrinum* and Necturus reveals the fact that there are four arches in Ambystoma and only three in Necturus. This raises the question as to which arch has been reduced in Necturus. Investigators in general consider that the fifth arch is lost and that the most posterior arch is the sixth. This conclusion conforms to the usual behavior of the fifth arch in other vertebrates. However, there is evidence that the ventral portion of the sixth has been lost—three, four and five remaining. The evidence is based on these facts:

(1) That all aortic arches in Necturus supply external gills. True external gills are not found on arch six in any amphibian.

(2) The aortic arches follow visceral arches numbers three, four and five, the sixth visceral arch being reduced to a mere vestige.

(3) A vestige of the ventral portion of the sixth aortic arch has been found.

The spiral valve and most of the septa of the bulbus are also absent in Necturus. All these structures are of great importance at the time of metamorphosis of Ambystoma and the absence of these seems to be responsible for the failure of Necturus to react to metamorphosing substances. Without these structures there is no possible way by which Necturus could even partially separate pulmonary and systemic blood. Blood going to the lungs would thus be of exactly the same nature, so far as oxygen content is concerned, as that going to the body. Being thus unable to develop an efficient pulmonary respiratory system, it is not surprising then that Necturus retains its gills.

[3] Laurens, Henry, *Physiological Rev.*, 1928, viii, 1; Mayer, Edgar, "Clinical Application of Sunlight and Artificial Radiation," 1926, 130–31, Baltimore.

To test the above theory the ventral portion of the sixth arch was ligated in Ambystoma, producing a specimen with aortic arches similar to those in Necturus. This operation was performed on a number of specimens, which were placed in a tank with an equal number of controls. All were treated with metamorphosing substances. It was soon evident that the gills of the controls were being resorbed, while the gills in the Necturus-like specimens were still full length and in perfect condition.

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HALIBUT FISHING

A RECENT report by the International Fisheries Commission reveals that, should the present rate of halibut fishing be continued for any length of time, the industry will be reduced to insignificance. Accordingly, a movement to save it is well under way, and stringent regulatory measures have been proposed.

It is pointed out that not only has there been a fall in the abundance of fish, especially on the older banks, which has fallen to 16 per cent. of the abundance in 1906, but there has been a decrease in the size of the fish, this being regarded as especially serious because of the very slow growth of halibut. As an adult fish is from twelve to twenty-five years old, the fish to be caught in the next ten years are already hatched and the yearly abundance for that period has been established. If these fish are greatly reduced in numbers and the present intensity of the fishery is maintained, according to the commission, the outlook for a stock of spawning fish sufficient to maintain the supply is rather hopeless. In fact, few mature fish are now found on the older banks.

Although there is a complete cessation of halibut fishing for three months each year, this measure is not adequate. The commission recommends as a minimum requirement that the halibut fishing be limited annually to some fixed proportion of the existing stock. In agreement with the best scientific opinion, it concludes that the taking of a fixed proportion of the halibut equal to that at present taken might ultimately stabilize the industry, since there are indications that the fish could survive under such conditions. Another measure proposed is the closing of two "nursery areas," one off Massett Graham Island, B. C., the other off Noyes Island in southwestern Alaska. In fact, the ultimate closing of all such areas is recommended. Furthermore, general restrictions are regarded as indispensable.

BIRGER R. HEADSTROM

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THE FUNCTION OF THE LATERAL LINE ORGANS

EXPERIMENTS on the lateral line organs of fishes have indicated that they are of importance in equilibration and that they respond to slow vibrations and possibly to the streaming of water, but I am unaware of any adequate explanation of their function or of the natural stimuli to which they respond. The following hypothesis is offered.

I would suggest that the organs are sensitive to pressure, relative rather than absolute. While the fish is on an even keel, the weight of a column of water reaching from the surface to either lateral line is the same, but when the fish turns on one side the weight pressing on the upper line system is less than that pressing on the lower. Possible action currents set up in the nerves would no longer balance, and in order to restore the "zero potential" the fish would have to carry out the proper muscular contractions to get back on an even keel. The analogy with the Wheatstone bridge is suggested.

In similar fashion, depression of the head with respect to the tail would bring about a difference in pressure between the cephalic and caudal portions of the lateral lines, resulting in efforts to restore the normal posture. The division of the cephalic portion into upper and lower branches may take care of the possibility of swimming bottom-up, the branches being adjusted to a normal difference in pressure.

To test this hypothesis a jar containing small fish was centrifuged in the horizontal and vertical planes. The dorsal fins pointed constantly toward the surface of the water. The fish swam around the periphery of the container against the slight rotatory current induced by the centrifugation.

WALTER FREEMAN

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REPORTS

THE FOURTH GENERAL ASSEMBLY OF THE INTERNATIONAL RESEARCH COUNCIL[1]

THE present convention under which the International Research Council was set up lapses on December 31, 1931, unless it is previously renewed. It is quite generally recognized that the renewal of the convention will carry with it changes in the statutes. The whole question therefore involves careful consideration of the conditions on the part of the nations adhering to the council. In view of these circumstances, the delegates of the Royal Society brought forward the following resolution:

> That a committee be appointed to consider what changes, if any, should be introduced into the statutes of the International Research Council and its unions to take effect on the expiration of the present convention (December 31, 1931).

This was strongly supported by the delegates from the United States and Holland and by the delegates from Italy and Czechoslovakia. After general and somewhat vigorous discussion, in which the question whether changes were required was raised in some quarters, the resolution was adopted.

Perhaps fully as important as the resolution organizing the committee were the instructions given to it. Though the discussion was animated and some questions were raised as to the far-reaching effects of the instructions, they were adopted in the following form:

> That for this purpose the committee shall enter into communication with the unions, the bodies adhering to the council and such other bodies and persons as it may consider advisable, and present a report to the executive committee of the council not later than June 30, 1930.

It is to be noticed that for the purpose of outlining the new convention the unions are to be consulted. This should tend to allay the restiveness in certain unions arising from the feeling that their organization and statutes were imposed by the council and are not easily changed.

The committee's membership is:

France: Picard and Lerié.
Great Britain: Glazebrook and Lyons.
United States: Kellogg and Schlesinger.
Italy: Volterra and Giannini.
Belgium: Pelseneer.
Denmark: Knudson.
Spain: Cabrera.
Japan: Sakurai.
Holland: Went.
Poland: Kostanecki.
Sweden: Siegbahn.

Sir Henry Lyons is secretary of the committee and it is fortunate that the work of this important committee is to be directed by such an able administrator, who at the same time understands and is in sympathy with the attitude of the unions. It augurs well for a satisfactory organization of the International Research Council and its relationships to the unions.

Among changes suggested in the informal discussion among members, the opinion was widely expressed that the tenure of office of the president and members of the executive committee should be fixed by the statutes and made rotational as is being done in the unions by statute or precedent.

[1] Brussels, July 13, 1928.

The relationship between the council and the unions will be greatly eased by the following resolution adopted by the General Assembly:

The General Assembly is favorably disposed to the freedom of the unions to alter their own statutes within the limits assigned by the statutes of the International Research Council and hereby empowers its executive committee to exercise the powers of approval conferred upon the council in Statute 5.

Statute 5 reads:

The statutes of the unions formed by the International Research Council require the approval of this council.

The above resolution not only assures sympathetic consideration of the desires of the unions on the part of council, but also makes possible action by the executive committee in the long intervals, usually three years, between the meetings of the General Assembly.

The delegates from the United States were Dr. Moore, of Purdue University, and Dr. St. John, of Mount Wilson Observatory.

CHARLES E. ST. JOHN

VITAMIN B TERMINOLOGY

IN November, 1927, Dr. E. V. McCollum, president of the American Society of Biological Chemists, received the following communication from the British Committee on Accessory Food factors:

Dear Sir:

At a meeting of the Accessory Food Factors Committee (appointed jointly by the Lister Institute and the Medical Research Council, 1918) and others interested in vitamin research in this country,[1] which was held on November 14, 1927, at the Lister Institute, under the chairmanship of Sir Frederick Gowland Hopkins, a discussion took place upon the nomenclature of vitamin B and its recently defined constituent parts.

The committee feel strongly that those workers in this field of research, should, if possible, arrive at some provisional general agreement regarding this point, so that references in the literature emanating from different schools may be uniform and unnecessary complications may be avoided.

The following suggestions were unanimously supported by those present: (1) That pending further investigation, much confusion will be prevented if the designation vitamin B, first used by McCollum and Davis and now firmly established in the literature, should be retained for all dietary factors belonging to this group of water-soluble vitamins. (2) That the term vitamin B_1 should be adopted for the antineuritic (more heat-labile) water-soluble dietary factor which was first discovered by Eykman in 1897 and is required to prevent polyneuritis in birds and marasmus with, or without, paralysis in mammals and beriberi in man. (3) That the term vitamin B_2 should be adopted for the more heat-stable, water-soluble dietary factor, recently described and named P–P ("pellagra-preventive") factor by Goldberger, Wheeler and Lillie and Rogers (1926) and found necessary for maintenance of growth and health and prevention of characteristic skin lesion in rats, and considered by the latter workers to be concerned in the prevention of human pellagra.

Such a scheme as the above possesses the advantage that place could conveniently be found to include any other constituents of this group which might be discovered subsequently.

The committee was of the opinion that the term "Bios" should be retained to denote the factor or factors encouraging rapid growth of yeast cells.

The committee have instructed me to forward the above suggestions to the American Society of Biological Chemists in the hope that they may be brought to the notice of its members and may invite their comments and criticism. It is held that all will agree upon the necessity of reaching agreement upon this point.

A copy of this letter has, at the same time, been forwarded to the British Biochemical Society and to some of the principal workers in this field of research on the continent and in the United States of America.

I am, yours faithfully,

(Signed) HARRIETTE CHICK,
Secretary

In response to this communication President McCollum appointed (in December, 1927) a Committee on Vitamin B Nomenclature to report at the April meeting of the American Society of Biological Chemists. This committee consisted of H. C. Sherman (Columbia University), Atherton Seidell (Hygienic Laboratory, Washington, D. C.), P. A. Levene (Rockefeller Institute for Medical Research), Harry Steenbock (University of Wisconsin) and R. Adams Dutcher (Pennsylvania State College).

Opinions of several interested workers, in addition to the members of the committee, were sought and letters were received from others. A total of fifteen workers have written the committee expressing their views. In many cases the opinions expressed represented the opinions of from one to eight coworkers.

The opinions expressed by the various groups of American workers were far from unanimous, the majority voting unfavorably on the suggestions of the British committee, except for the suggestion regarding the retention of the term "Bios." No letters have been received expressing opposition to this suggestion. Analysis of all suggestions submitted indicates that American workers favor three different

[1] Sir Frederick G. Hopkins, F.R.S., *chairman;* Professor J. C. Drummond; Professor A. Harden, F.R.S.; Sir Charles Martin, F.R.S.; Professor E. Mellanby, F.R.S.; Professor R. H. A. Plimmer; Professor R. A. Peters; Dr. Harriette Chick, *secretary.*

systems of nomenclature for the components of the vitamin B complex.

In brief the three systems of terminology suggested may be described as follows:

(1) *The British suggestions:* This terminology would use the letter B to designate the complex, B_1 to identify the heat-labile factor, and B_2 to refer to the heat-stable factor or factors which have to do with appetite and growth stimulation, amelioration of skin affections, etc.

(2) *The Sherman suggestions:* Dr. Sherman suggests the term F to designate the heat-labile factor and G to identify the heat-stable fraction.

(3) *The McCollum suggestions:* Dr. McCollum suggests that the term B be restricted to refer to the heat-labile factor, since it was the first one studied, and to create new letter designations for subsequent components of the complex as fast as they are recognized as separate entities. He suggests the letter F (or G) for the heat-stable factor. Other suggestions were made, but since they were not supported by many workers, reference to them will be omitted.

It is impossible to do more than summarize the arguments of the proponents of the various systems of nomenclature. The letter from the British committee, quoted above, will give the reader the reasons for their suggestions.

On January 10, 1928, Dr. Sherman wrote the following letter in explanation of his suggestions:

(1) I concur in the recommendation of the British Committee that the term "Bios" be retained as stated.

(2) I concur in the implied recommendation of the British Committee that no one substance should hereafter be designated by the unqualified term "Vitamin B."

(3) For the two now recognized substances formerly covered by the term vitamin B, I think that the designations "Vitamin F and G," proposed somewhat over a year ago in the *Journal of Chemical Education* and also last summer in the *Journal of Biological Chemistry*, are much preferable to the designation B_1 and B_2 proposed by the British Committee.

To discuss all the advantages which, in my judgment, are possessed by the designations F and G over B_1 and B_2 would make this letter too long. A few of them are as follows:

(a) *Consistency with the accepted plan of designation* of the vitamins by letters, according to which each substance of this group, when its existence has been sufficiently demonstrated, receives as designation a separate capital letter, assigned in alphabetical sequence as the need for each becomes clear. The designations F and G are entirely consistent with this established and accepted plan, while the designations B_1 and B_2 are not consistent with it, since they use the same letter for different substances.

(b) *Definite freedom from unwarranted implications* in the case of the designations F and G, whereas the designations B_1 and B_2 imply (would certainly suggest to many if not most readers) that these two substances are more closely related to each other than are any other two substances of the vitamin group (vitamins A and D, for example), an implication which may or may not prove true but for which there is I think no adequate evidence at the present time.

(c) *Very great advantage in presentation* to students and to the public. The reason for having new designations is that we are satisfied that the two factors are separate substances. This is clearly indicated by the use of the terms F and G, whereas the use of the terms B_1 and B_2 might easily lead to the supposition that they are merely two forms or phases of the same substance. Designations involving subscripts are awkward to speak, to typewrite or to print. The frequency with which we see ultra-violet rays referred to as "violet rays" in the newspapers should warn us that in practice the subscripts would often be slighted and either B_1 or B_2 would be liable to appear as "vitamin B" in a newspaper or other popular presentation (as well as in students' notes). And still greater would be the confusion if we should later have a B_3 and perhaps a B_4, whereas if we adhere to the plan originated by McCollum, developed by Drummond, and uniformly followed hitherto, *viz.*, that of giving *each recognized vitamin a separate capital letter*, there should be little danger of confusion either in technical or non-technical discussions.

In a recent letter, Dr. Sherman expresses the opinion that he is not interested in retaining the term B to denote the complex. In fact he feels that nothing would be lost if the term B should be given "honorable retirement," leaving this space blank in the system of vitamin nomenclature.

Sybil L. Smith has already advanced arguments for Dr. Sherman's suggested system of terminology.[2]

The following letter of Dr. McCollum, written on February 24, advances arguments in support of a third method of terminology:

(1) Each vitamin principle essential to the rat should be recognized as a separate entity; each should receive a separate name. There should be no attempt at grouping them into an artificial complex, that is, subordinating them to a generic name. The substances should be treated as individual factors of equal rank.

(2) Provision for vitamins which may be discovered in the future but which are at present unknown.

The terminologies proposed by Goldberger, Salmon and Chick and Roscoe are open to criticism because they violate the first criterion. They take the unnecessary, indeed, misleading step of supplying the complex with a

[2] SCIENCE, lxvii, No. 1741, 494, May 11, 1928.

name, implying a subordinate rôle for each factor of the complex. The recommendations of the Accessory Factor Committee show even more subordination of the independent substances not only in assigning a generic name to their artificial complex, but also in giving subnumerals to the constituent factors. In addition, the numerals possess no advantage over the generally accepted system of letters. The same criticisms may be levelled against figures as against letters, but usage has made adherence strictly to letters very desirable.

The system that meets the criteria most exactly is Drummond's modification of McCollum's original plan. This deals with each vitamin as an entity; there is no grouping or subordination. Further, it provides for additional members as rapidly as they are recognized.

We have seen that at present only two factors, the thermo-labile antineuritic principle, and the thermostable anti-pellagrous principle need identification. Adhering to the McCollum-Drummond plan involves a new use for the term vitamin B as a definite factor, else it becomes a blank in the scheme. It can not be used in its old sense.

It is proposed that:

(1) The term vitamin B be adopted for the antineuritic (more heat-labile) water-soluble dietary factor which was first discovered by Eykman in 1897 and is required to prevent polyneuritis in birds and marasmas, with or without paralysis, in mammals, and beri-beri in man.

(Vitamin B even in its older sense has been generally regarded as thermo-labile, and the antineuritic effect has long been associated with this term. For these reasons the thermo-labile antineuritic principle rightfully merits the priority to the term vitamin B. In this proposed scheme vitamin B has merely a more restricted meaning than formerly.)

(2) The term vitamin F (or G) should be adopted for the more heat-stable water-soluble dietary factor described and named by Goldberger, Wheeler, and Lillie and Rogers as factor P–P, and found necessary for maintenance of growth and health and prevention of characteristic skin lesions in rats, and considered by the latter workers to be concerned in the prevention of human pellagra.

(This factor was discovered as an independent principle by Goldberger, *et al.*, and should be treated as a separate vitamin, taking the next available letter in the alphabet, namely F (or G).)

(3) No generic name shall be given to all dietary factors belonging to this group of water-soluble vitamins, since it is not only unnecessary but also misleading. In fact, mention of "complex" should be abandoned.

(Vitamins B and F (or G) are independent factors on equal rank with all other vitamins, and need no collective term.)

(4) Recognition of existence of additional water-soluble vitamins in the future shall be met by taking the next available letter in the alphabet, following the usual prefix vitamin.

(5) Bios shall be retained to designate the factor or factors encouraging rapid growth of yeast cells.

Under date of February 6, 1928, Dr. Steenbock advanced the following reasons for his preference:

Previous to the organization of the committee, I was in receipt of the report of the British Accessory Food Factors Committee to which my reaction was very unfavorable. To include the heat-labile and the heat-stable factors, and possibly others, under vitamin B differentiated by subscript suggested to me a common parentage or at least a greater relationship between them than appears justifiable on the basis of present knowledge. If the precedent of such a system were once established for any one vitamin, then it would soon be used for others. For instance, I see no reason why it would not be quite justifiable to use such a system in connection with vitamin A and the antirachitic factor.

When I read Dr. Sherman's suggestions in the *Journal of Chemical Education* that the term vitamin B should be used for the B *complex* and that heat-labile and heat-stable factors should be designated respectively vitamin F and G, my reaction was again unfavorable. In the first place, I see no reason why a vitamin complex of variable quantitative composition should be designated by a letter and, in the second place, I see no reason why the heat-labile antineuritic factor should not be accepted as vitamin B. If historical back-ground counts for anything, it may be recalled that it was McCollum's belief that his water-soluble vitamin B was identical with Eykman's antineuritic principle. Why not continue the use of the term vitamin B in this sense irrespective of its relationship to growth and then use the letter F (or G) for the designation of the heat-stable P. P. factor of Goldberger.

I quite agree with the opinion expressed by the British Accessory Food Factors Committee that it is advisable that the term Bios be retained. In fact I see no reason why other names of suitable designation should not be used by various investigators in their own field of investigation until accumulated evidence warrants the inclusion of the newly discovered factor among the vitamins needed by the animal. It seems to me that it would be expecting too much to have all substances of the nature of vitamins which are indispensable for different types of life to be immediately included in the alphabetical system of nomenclature. When it is found that such substances are indispensable for animals their final inclusion in this system could then be decided upon by a committee on vitamin nomenclature reporting in this country to the Federation of American Societies for Experimental Biology.

From the above you can see that my ideas are quite reactionary to contemplated changes. In fact I am quite convinced that such confusion as threatens us is due not to inavailability of a proper system of nomenclature, but to a paucity of experimental facts and to a certain hastiness in naming. The former will ultimately correct itself, the latter can be corrected by delegation.

Many workers merely wrote that they favored one system or another, without detailed reasons for their opinions. Dr. Sybil Smith's letter in support of the Sherman suggestions has already been published, in substance, and will not be included here.

Nutrition workers will also be interested in the following quotation from Dr. H. H. Mitchell's letter of April 10, 1928.

> There is no question but that the situation with respect to the nomenclature of the components of vitamin B is confusing. The use of the letter B has been so generally applied to what was thought to be a definite dietary factor with growth-promoting and antineuritic properties, that its entire elimination from the list of vitamin letters seems advisable to me. Even its use to denote the combination of the two or more water-soluble components, as has been suggested, seems objectionable to me, since it would refer to no definite combination of dietary factors and hence would have no definite significance. I can not conceive of any situation requiring the use of such a loose term.
>
> The A and D situation was not analogous to the B situation, since, in this country at least, vitamin A was not at all generally confused with the antirachitic factor, so that the discovery of this factor, although possibly vitiating some of the work done on vitamin A, did not modify the meaning generally attached to this term.
>
> I favor the use of new letters to designate the components of vitamin B, but I feel that there is danger of making the same sort of an error in defining vitamins F and G as was made in defining B, with the same unfortunate confusion of ideas and the same misdirected experimentation. There is such a general feeling of satisfaction in the establishment of the identity of two factors in any scientific problem, because its ultimate solution is to that extent simplified, that the pronouncement of such an identity is frequently not subjected to the critical scrutiny that its importance deserves. In the present case, there is nothing to be gained, and the possibility of considerable confusion is incurred, by identifying vitamin F (investigated in rat-feeding experiments) with the antineuritic vitamin and, particularly, vitamin G with the antipellagra vitamin, if such there is, until the evidence of these identities is established beyond a reasonable doubt. I think Sherman's statements on this matter are premature.
>
> To my way of thinking it is time, in these days when pronouncements of new dietary factors are becoming so frequent, to come to some general agreement concerning the proper criterion for the demonstration of a new vitamin. Surely the statement that a new vitamin exists should be something more than the mere expression of one's inability to explain experimental findings on any other basis. The factor should be obtained in a potent and concentrated form, the addition of which in minute amounts to a ration, preferably synthetic in character but in all cases demonstrably complete in all other known respects, will *invariably* induce a marked betterment in the nutritive condition of properly prepared experimental animals, an effect which is not dependent upon an increased intake of food. Some such criterion should be satisfied, preferably by more than one investigator working independently, before a letter in the vitamin series is assigned to a new dietary factor. Conservatism in such matters is the wisest policy to pursue.

It would appear that a majority of workers, who have indicated a preference, are quite agreed (in the light of Dr. Herbert Evans' introduction of vitamin F) on the use of the term "G," to denote the heat-stable factor. Some difference exists, however, relative to the term which should be used to designate the heat-labile antineuritic factor.

The committee is not ready to make its final report and it will welcome suggestions from all interested workers in the vitamin field. Steps are now being taken to cooperate with other scientific groups before making definite recommendations.

The members of the committee feel that the naming (by other than descriptive terms) of newly discovered food factors should be discouraged until a system of terminology has been agreed upon. Many workers have expressed themselves as being in favor of discouraging the designation of new vitamins until their identity has been established beyond question. In this the committee is in accord.

Suggestions have been made that an American committee be appointed, representing the interested scientific societies, which may act as a clearing house for questions in vitamin terminology and perhaps cooperate with similar foreign committees in actually naming new factors. This suggestion is made with the hope that it will avoid confusion in the literature and promote uniformity, which is highly desirable.

R. ADAMS DUTCHER, *Chairman*,
Committee on Vitamin B Nomenclature, American Society of Biological Chemists, Pennsylvania State College.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

ELECTRICAL APPARATUS FOR THE ACCURATE GENERATION AND MEASUREMENT OF NOISE AND TONE

THE scientific study of noise is becoming of increasing importance in recent years due to recognition of its possible harm and wastefulness. Since preliminary tests seem to indicate that different pitches vary considerably in their annoying properties, the apparatus used must be accurate and reliable with respect to pitch, maintaining it over long periods of time, and furnishing it at will. Intensity must be accurately controlled and must be reproducible at any time.

As has been first pointed out by the late Wallace Sabine, the total amount of noise in a room varies with the absorption of persons, rugs, walls, furniture, etc. Either these conditions must be kept uniform or the ideal instrument must automatically compensate for the variation in absorption units from one room to another. If a standard physical adjustment of intensity is used on the source of sound, the perceptible sound intensity will vary when it is moved from one room into a more absorbent room. For noise tests at the Colgate Psychological Laboratory, for instance, we have a cubical room, lined on the walls and ceiling with acousticelotex, and whose period of reverberation is .12 seconds, but for field work where physical conditions vary from one factory to another our noise machine must be correctible to give reliable results.

The orthodox methods for the production of auditory stimuli consist of mechanical means almost entirely. The most common form of apparatus is of the type of the Stern tone variator. Experiments have been performed in which tin cans have been dragged across the floor and phonograph records played. In tests at the Colgate laboratory last year a rotating hexagonal drum filled with bolts and screws was used as a source of noise. However, these sounds are not satisfactory for scientific purposes, since there is so much variability and lack of control, and they are not easily resolved into components of pitch and intensity. Apparatus has been developed and is being used by the laboratory which can easily supplant former methods such as the ones described.

This apparatus consists of three major divisions: an unvarying source of sound, an amplifier and a loudspeaker to spread the sound throughout the room.

The Tone Generators

As a source of sound we have two forms of apparatus. The most successful of these consists of audio-oscillators manufactured by the General Radio Company, and are used in our permanent set-ups. These consist of tuning-forks which are actuated by a six-volt storage battery and generate a small alternating current of .5 to 5 volts at the same frequency as the fork. The second form which is being developed is a portable set-up using high-frequency radio buzzers which have the advantage of light weight and low cost, and are fairly unvarying when used only for a few minutes at a time. For more specialized work where intermediate points of the scale are desired, the beat frequency oscillator of the General Radio Company is used, wherein two vacuum tube circuits, oscillating at different frequencies, beat on one another with a range of from twenty to nine thousand cycles.

Amplifying the Standard Tone

The alternating current produced by the oscillators is fed into the primary circuit of the first transformer of an ordinary radio amplifier. We have found three stages of radio amplification satisfactory for most purposes. The input coming from the tone generator is fed into the first transformer, whose secondary is in the grid circuit of a Daven UX-201 A tube. Standard transformer-coupled amplification with 3 to 1 ratio audio-frequency transformers steps this up through three stages. The tubes have 135 volts on their plates, and operate on six volts supplied by a storage battery. For field work dry cells are used and may be contained in a box about 15″x10″x6″ having the set mounted in the top.

Where a source of direct current of more than 135 volts is available for plate voltage, power tubes and transformers are very satisfactory for increased volume. Since the energy output of the amplifier depends on how much energy is put into it, an increased voltage, if the tubes are built to stand it, will raise the upper limit of volume. Using 135 volts on three UX-201 A type tubes, in a room having a period of reverberation of about one second, we are able to get about 75 T. U.

Measuring the Intensity Produced

The output of the amplifying unit is passed into an audibility meter and loudspeaker which can be calibrated to read in standard transmission units (T. U.) or audibility sensation units. Due to individual characteristics each loudspeaker unit must be calibrated separately with a volume control.

To protect the loudspeaker unit and to eliminate possible distortion, it may be advisable under certain conditions to insert an output transformer between the output of the amplifier and the loudspeaker unit.

Frequencies of 500, 1,000 and 1,500 cycles are sufficient for our purposes. These may be combined in any form desired. All three frequencies may be imposed on the same amplifier and loudspeaker, but the result may not give distinct pitches due to individual differences in the loudspeakers. Some loudspeakers are best adapted to low frequencies up to 1,000 cycles, while others take the 1,500 cycle pitch better than the two lower ones. We recommend an individual amplifier and loudspeaker for each desired pitch.

The regular 60-cycle alternating current lighting circuit may be used to supply a low 60-cycle tone. The current is passed through a toy transformer, with taps for graduations in voltage, into a suitable loudspeaker.

This apparatus for making tests on noise gives us a constant pitch of tuning fork accuracy; there is a complete range of intensity variation possible; it is mechanically simple to operate with only loose tubes and battery charge to watch; it will generate and amplify without variation for twenty-four hours at a time; it can be built in portable units; and through the use of the audibility meter it almost automatically compensates for variations in the tonal intensity, due to being placed in a sound-reverberant or in a sound-absorbent room.

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SPECIAL ARTICLES

MUTATION, CHROMOSOME NON-DISJUNCTION AND THE GENE[1]

MODERN genetics distinguishes several types of mutations; gene mutation, where only one gene is affected; deficiencies, where a whole series of genes may be dropped out; chromosomal mutations, where the effect is due to irregularities in chromosome behavior or number as in non-disjunction, triploid or sex intergrade formation, etc. For some years flies of unique appearance have sporadically appeared in certain of my experiments, which under the older terminology would be considered mutations, although they appear best considered under the more limited rubric as due to chromosome non-disjunctions and not mutation in the gene sense. The variable nature in the time of appearance of these abnormal forms makes them resemble fluctuating mutations which are of so much interest in connection with the mechanism of mutation. The abnormal flies represent morphological variates extending all the way from male on the one hand to female on the other. Cytological analysis of the chromosomes shows that the sex intergrade forms are the result of a multiplication of the chromosome groups in the mother fly to form eggs with double the ordinary number of chromosomes. The sex intergrades consequently carry three sets of autosomal chromosomes and two sex chromosomes. Another class of females, showing increased size and larger eye pattern, have three full sets of chromosomes or are triploids. Incidentally, therefore, these results furnish independent confirmation of Bridges' hypothesis that sex is determined by a balance of the sex chromosomes and autosomes. In this antagonism of forces the sex chromosomes have a female tendency, while the autosomes have the male tendency. Extensive pathological changes are found in these forms; instead of all male parts going together or all female parts together, all manner of combinations of the two are witnessed. In fact, the study of the unbalanced conditions shows that external appearance is not always a criterion of internal structure, since female-appearing sex intergrades may have testes and male-appearing intersexes may have ovaries.

The frequency with which these mutant forms appear within this stock is many times that in normal stocks. Careful examination of a normal stock of 15,785 flies showed but one triploid mutant and no sex intergrades. On the other hand, examination of 1,775 flies from normal appearing parents in the sporadically mutating stock showed thirty-four sex intergrades and triploids, or a rate of one in fifty-two flies, three hundred times as frequent as in the normal stock. These two sets of flies were grown in the same bottles under as nearly the same conditions as possible. The classification is believed to be accurate, as many of each class have been bred to test genetically the accuracy of the separation, with results which have thus far checked perfectly. Another stock made by outcross and extraction showed in 1,173 flies thirty-seven sex intergrades and triploids, or a rate of one to thirty-one—500 times the normal rate. Besides these exceptional classes two others appear. The first is the familiar exception to sex linkage due to non-disjunction of the sex chromosomes. These appear in large numbers. The second mutant involves the vigor of the fly, the bristles, the eyes and fertility and has some of the characteristics of a dominant.

Genetic analysis designed to determine the causative agent behind this series of phenomena shows that a third chromosome recessive factor controls these events. This factor is inactive in the male, as males homozygous for the factor never produce exceptions. In the homozygous females the exceptions freely occur. With the single dose, heterozygous, or when this factor is absent these mutant flies rarely appear. This factor for mutant production is associated with and probably identical with a factor which causes practically complete linkage or lack of separation of any of the factors in any chromosome in the female. It is evident from these facts that the chromosomes of the male and female Drosophila pass through phases which must be divergent in at least two particulars, chromosomal linkage and disjunction. That one factor should be capable of throwing the whole mechanism of mitosis out of gear, even to altering the behavior of the chromosomes in which it is not located, is an extremely interesting fact. The action of this gene finds expression only in the female's progeny, making the case look like one of maternal inheri-

[1] From the Department of Animal Pathology of the Rockefeller Institute for Medical Research, Princeton, N. J.

tance when, in truth, the causative factor is transmitted by both sexes and under strict Mendelian rules. The location of the factor within the chromosome is of interest, as the results show it to be at or near the point of this V-shaped chromosome where presumably the spindle fiber attachment takes place. This fact may be significant in view of the evidence accumulating to show that the spindle fiber attachment is frequently associated with abnormalities in chromosome behavior. The frequency of occurrence of these mutant forms points to their random distribution within any female's progeny and, therefore, that the non-disjunction of the chromosomes occurs in the last oogonial divisions or later. The non-disjunction generally involves both the paternal and maternal sex chromosomes and not, as might be the case, only paternal or maternal chromosomes.

John W. Gowen

REGULATING THE STORAGE OF VITAMIN A IN ANIMALS THAT ARE TO BE USED FOR THE DETERMINATION OF THIS VITAMIN

The following observations and considerations led to a study of the problem of the storage of vitamin A in rats reared under carefully controlled conditions:

(1) In a previous study of this problem by Steenbock, Sell and Nelson,[1] the authors were cognizant of the possible influence of the consumption of the stock diet by the young on the storage of vitamin A.

(2) It is extremely difficult to have a uniform supply of A in any stock diet. The instability of the vitamin and its consequent variation in natural foods, particularly foods in such a state of comminution as to prevent selection from the diet, is one of the problems to be dealt with.

(3) Keeping animals on a diet which is low enough in vitamin A to insure a low storage in the young may interfere with satisfactory reproduction if the level becomes just a little too low.

(4) Some data obtained in studies in this laboratory on a prophylactic technique of vitamin A determination in which the rats were given a single or limited number of feedings of vitamin-containing material were difficult to interpret because of the variations in the time of onset of symptoms of vitamin A deficiency.

(5) If mother rats are kept on a diet which insures a very generous supply of A, so that the milk at all times contains a maximum amount of this vitamin and the young receive no other vitamin A than that which is contained in the mother's milk before they are put on a vitamin A free diet, will such young be suitable for vitamin A studies?

Information on the storage of vitamin A in young rats was obtained under the following conditions: Stock rats were bred when kept on a diet that included a generous supply of cod liver oil known to be very potent in vitamin A. Pregnant females were segregated. Litters of six animals were used, and the number of rats in a litter was reduced when necessary. Mothers were put on an A-free diet, some the day the young were born and others when the young were five, ten, fifteen, sixteen, seventeen, eighteen, nineteen and twenty days old. When the young had attained a weight of from forty to forty-five grams they were weaned and put on the A-free diet. If the mother is put on the A-free diet when the young are sixteen to eighteen days of age and weigh not less than twenty-seven or more than thirty grams, and the young are weaned when they weigh from forty to forty-five grams, the onset of symptoms of vitamin A deficiency in the young seems to be independent of the amount of vitamin A given the mother during the entire period of lactation, provided a certain minimum level is not reached. On such a regimen, for the past six months the animals in this laboratory have shown definite symptoms of vitamin A starvation between the fifth and sixth week after weaning. Ophthalmia from vitamin A deficiency seems to occur with the greatest degree of regularity in rapidly growing animals, and our experience indicates that animals do not grow rapidly if the mother is put on the A-free diet before the young are fifteen days old. It is possible that this retardation in the growth of rats can be eliminated by adjusting the diet of the mother, but for the results desired this seems to be unnecessary. Animals that weigh much more than thirty grams will eat the stock diet. All rats which were put on the A-free diet at the age of nineteen days or more showed a distinct delay in the onset of ophthalmia as compared with those which were put on the A-free diet before that age.

It seems very probable that by following the essentials of the technique outlined herein with rats reared in any laboratory the storage of vitamin A will be comparatively uniform. There is the added advantage of maintaining the stock animals on a diet which is known to be adequate in every respect. There has been no indication that the time the females are kept on the A-free diet (from five to eight days) is long enough to deplete her reserves of A to the extent that it becomes apparent.

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[1] Steenbock, H., Sell, M. T., and Nelson, E. M. *J. Biol. Chem.*, Vol. 56, p. 327. 1923.